

REMARKS

Claim 3 is canceled herein and claims 1, 2, 4, 5 and 6 are amended. Support for the amendment to claims 1 and 2 is found, for example, in the original claims, namely original claim 3, and in the Examples in the specification. Further, claims 2, 4, 5 and 6 are amended to correct minor informalities and the clerical error in the Amendment filed on April 14, 2003, on page 3, reciting formula (3), which was intended to be deleted is corrected. Hence no issues of new matter are presented.

Upon entry of the Amendment, which is respectfully requested, claims 1-2 and 4-14 will be all of the claims pending. This amendment is based on the Examples in the specification. By this amendment, the polymeric fluorescent substance 4 which was erroneously recited as an Example at the time of filing the present specification becomes outside claim 1. With amended claim 1, it is believed the rejection under 35 U.S.C. § 112, first paragraph, is overcome.

I. Response to Claim Rejections Under 35 U.S.C. § 112, 1st Paragraph

Claims 1-14 are rejected under 35 U.S.C. § 112, 1st paragraph, allegedly because the specification does not reasonably provide enablement for the full scope of polymers, EL devices and articles incorporating EL devices encompassed by the present claims.

Applicants respectfully traverse the rejection and submit that the claims as amended are sufficiently enabled by the specification. Claims 1 and 2 are amended herein by incorporating the subject matter of claim 3, namely Ar₁ in the formula (1) of claims 1 and 2 is replaced by the structure shown by the formula (5) of claim 3. The polymeric substance 4 disclosed in the present specification does not fall within the scope of the claims, as amended.

In a copolymer, the technique of evaluating local HOMO, LUMO and bandgap of the homopolymers of each of the repeating units that constitute the copolymer, is well known to those of ordinary skill in the art, as described in WO 92/03490 and US 5,543,079. See the attached excerpts from the these references. Thus, in view of the knowledge and skill within the art and in view of the guidance and Examples, namely Example 1 provided in the present specification, one of ordinary skill in the art would readily be able to understand and practice the full scope of the claimed invention.

In the present invention, $1239/\lambda$ for absorption edge wavelength (λ) of a homopolymer corresponds to the bandgap energy of the homopolymer. Therefore, in the present invention, when the homopolymer consisting of formula (1) and the homopolymer consisting of formula (3) are compared, the homopolymer consisting of formula (3) has a smaller bandgap.

In a copolymer, the fluorescent peak wavelength originates in luminescence from the portion where the bandgap is the smallest, and it is the wavelength corresponding to the bandgap energy of the homopolymer consisting of formula (3) which is a repeating unit having the smallest bandgap. Moreover, in a homopolymer, the fluorescent peak wavelength and the absorption edge wavelength are nearly the same, and this is a wavelength equivalent to the bandgap energy. Therefore, the fluorescent peak wavelength of a copolymer coincides with the absorption edge wavelength of the homopolymer consisting of formula (3). In this regard, the Examiner's understanding is correct.

However, in the copolymer of the present invention, only a small amount of the repeating unit of formula (3) is contained, and the characteristics of the copolymer are expected to be

easily influenced by the repeating unit of formula (1). In Table 1, the absorption edge wavelength of polymeric fluorescent substance 3 is 590nm, and the fluorescent peak of polymeric fluorescent substance 1 is 548 nm. The resulting short-wavelength is caused by the effect of the other repeating units. However, even when the values of 548 nm and 425 nm are used, condition (c) is satisfied, and when the value of the homopolymer is used, condition (c) is satisfied as well.

As above, in a copolymer, the difference between fluorescent peak and absorption edge wavelength generally becomes smaller than the values estimated from the respective homopolymers, but in the case where condition (c) is satisfied by using these values, condition (c) must be also satisfied in the homopolymer. Therefore, even though the examples of the homopolymers are not provided, the relation between the bandgap energy of the repeating unit having the smallest bandgap, and the bandgap energy of the main component (contained in larger amount) can be estimated from the fluorescent peak and absorption edge wavelength of a copolymer, respectively, and it can readily be determined whether the condition (c) is satisfied.

With respect to the Examiner's comments in the Advisory Action dated April 28, 2003, regarding the situation where the copolymer contains more than two different repeating units, Applicants submit the following.

In claim 2, the third repeating unit represented by formula (4) is used in addition to the two repeating units represented by formulae (1) and (3). The third repeating unit represented by formula (4) is selected to satisfy the conditions (d) to (f). With respect to the absorption edge wavelengths, the relationship between the repeating unit represented by formula (4) and the

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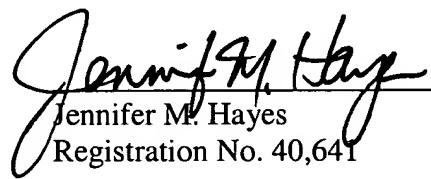
repeating unit represented by formula (3) is shown in condition (f), similarly with that between the relationship between the repeating unit represented by formula (1) and the repeating unit represented by formula (3). Thus, the claims are sufficiently enabled such that one of ordinary skill in the art would be able to practice the full scope of the claimed invention.

Accordingly, Applicants respectfully request withdrawal of the rejection.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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Excerpts from WO 92/03490 (CDT)

1. A semiconductive conjugated copolymer comprising at least two chemically different monomer units which, when existing in their individual homopolymer forms, have different semiconductor bandgaps, the proportion of said at least two chemically different monomer units in the copolymer to control the semiconductor bandgap of the copolymer so as to control the optical properties of the copolymer, said copolymer having been formed in a manner enabling it to be laid down as a film without substantially affecting the luminescent characteristics of the copolymer, said copolymer being stable at operational temperature.

Page 3, 4th paragraph:

A semiconductor is a material that is able to accommodate charged excitations which are able to move through this material in response to an applied electrical field. Charge excitations are stored in the semiconductor in states which are (or are derived from) conduction band states (in the language of quantum chemistry, lowest unoccupied molecular orbitals, LUMOs) if negatively charged, or valence band states (highest occupied molecular orbitals, HOMOs) if positively charged. The semiconductor band gap is the energy difference between valence and conduction bands (or from HOMO to LUMO).

Page 4, 1st paragraph:

The present application is primarily concerned with copolymers in which the material is made up of chemically distinct regions of polymer chain. A convenient description of the electronic states (molecular) orbitals) is one in which the wave functions are substantially localized on a region of chain of one chemical type. It is useful to define the semiconductor

bandgap locally, i.e., as the energy gap between HOMO and LUMO on a particular sequence of polymer chain to which the HOMO and LUMO on a particular sequence of polymer chain to which the HOMO and LUMO wave functions are substantially confined. One can expect to find a variation of gap from HOMO to LUMO between regions of one chemical type those of another. This may be described as a spatial modulation of the bandgap.

Excerpts from US 5,543,079 (Sumitomo Chemical)

1. A polymeric fluorescent substance which is soluble in solvents, has a number-average molecular weight of 103 to 107 and contains, as main constituents, three different repeating units A, B and C selected from the repeating units represented by the following formula (1), wherein the ratios of the respective repeating units in the polymeric substance are such that when the repeating unit constituting the polymer having the longest optical absorption edge wavelength is expressed by A, the repeating unit constituting the polymer having the next longest optical absorption edge wavelength is expressed by B, and the repeating unit constituting the polymer having the shortest optical absorption edge wavelength is expressed by C, A is contained in an amount of 2-60 mol%, B in an amount of 5-60 mol% and C in an amount of 20-50 mol% based on the total number of the three different repeating units:



wherein Ar is an arylene group having 6 to 20 carbon atoms.